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Review

Psychometric properties of Chronic Pain Acceptance Questionnaires: A systematic review

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ABSTRACT

Background: Theoretically, acceptance of chronic pain (CP) is an important determinant in the functional status and well-being of patients with CP. Several questionnaires that aim to measure acceptance of CP have been developed. An overview of the psychometric properties of these questionnaires is unavailable. **Methods:** A systematic review of the literature of the psychometric properties of questionnaires that aim to measure acceptance of CP was performed. Psychometric properties including content construct and criterion validity, internal consistency, agreement, reliability, responsiveness, floor/ceiling effects and interpretability, were assessed using a standardized protocol. All studies were assessed by two observers independent from each other.

Results: A total of 23 studies including 4 questionnaires or subscales were identified. The questionnaires/subscales included were the Chronic Pain Acceptance Questionnaire (CPAQ), Illness Cognitions Questionnaire (ICQ), Pain Solutions Questionnaire (PASOL) and Acceptance of Illness Scale (AIS) adapted to pain. When applying the criteria of the protocol, results indicate that none of the questionnaires are currently able to meet all 9 criteria for psychometric quality. Individual questionnaires met between 0 and 3 of the criteria.

Conclusions: If strict psychometric quality criteria are applied, none of the questionnaires are currently able to meet all nine criteria for psychometric quality, but overlooking the cumulative results over all the studies conducted, especially for the CPAQ, it can be concluded that information on several important characteristics has been reported and a fairly clear picture emerges about the psychometric properties of the CPAQ.

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1. Introduction

The psychological construct of acceptance is increasingly applied in treatment of patients suffering from chronic pain (CP). A progression of the use of the concept of acceptance of CP can be seen from the biomedical model and the biopsychosocial model to contextual models of CP (Dahl et al., 2005). This progression is characterized by a shift from medical or psychiatric explanations of pain and pain treatment, towards a multifactorial explanation and treatment. This shift provided room for cognitive-behavioral interpretations of acceptance as a form of coping behavior. According to the cognitive-behavioral model, cognitive responses such as

thoughts, beliefs, and expectations play a key role in the perception of pain and how people adjust to pain (Keefe et al., 2005). Contextual models, for example the contextual cognitive-behavioral model (McCracken, 2005a) describe the process in which a patient has to cope with the reality that pain is inevitable and uncontrollable. Acceptance of CP is assumed to play a central role in how patients live with CP. It is hypothesized that acceptance of CP relates to better functioning, less struggling for control over pain, a more vital life and accomplishing valued goals despite CP.

A growing body of research indicates that acceptance may be important in understanding individual differences in functioning with CP. Acceptance has been defined in different ways. Some have defined it as the active and aware embrace of those private events occasioned by one's history without unnecessary attempts to change their frequency or form, especially if doing so would cause psychological harm (Hayes et al., 2006). Others focus on the acknowledgment that pain can not be averted and on engagement

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in life activities despite the pain (De Vlieger et al., 2006), or refer to acceptance as the respondent's success in feeling "acceptant" and valuable in spite of problems and losses occasioned by pain (Rankin and Holtum, 2003). Altogether, these conceptualizations of acceptance refer to an underlying psychological state of willingness to experience CP and its cognitive and emotional facets while continuing life as normal as possible.

Treatments based on acceptance, such as Acceptance and Commitment Therapy (ACT) (Hayes et al., 1999), appear effective in improving functional status of patients suffering from psychopathology and medical problems, including CP (Dahl et al., 2004; McCracken et al., 2007b). According to the ACT model of psychopathology the psychological flexibility (contacting the present moment fully as a conscious human being, and based on what the situation affords, changing or persisting in behavior in the service of chosen values) can be increased by facilitating six core processes, one of which is one's ability to accept inevitable suffering.

For clinical use and for further research of acceptance of CP, it is necessary that acceptance of CP is measured reliably and validly. Several questionnaires were developed to assess acceptance of CP. It is, however, unclear which questionnaire can be used best in clinical practice and in research. The aim of this study was systematically review psychometric properties of the questionnaires used to assess acceptance of CP.

2. Method

The review was performed in three consecutive steps: (1) searching relevant computerized databases for identification of possible relevant studies, (2) study selection, (3) methodology assessment of the studies selected.

2.1. Search strategy

To identify studies on psychometric properties of questionnaires that are aimed at measuring acceptance of CP, the following databases were searched: Medline, Cochrane Library, PsycINFO, Embase and Scholar Google. The following search terms were used: CP AND acceptance AND questionnaire OR assessment. The search terms were entered as free text words combined with the relevant terms for each data base searched. The search was conducted over the complete available time a database provided, with March 2009 as the end date.

2.2. Study selection

Studies identified in the search were selected by two observers independently, who reviewed the abstracts of the studies. The following inclusion criteria were used:

1. The study was written in English, Dutch or German.
2. The study described a method of assessing acceptance of CP.
3. The study described results of psychometric research.
4. The study described results based on a population of adult CP sufferers.

Disagreement on the inclusion or exclusion of papers was to be resolved by a third reviewer. Furthermore, the selection of papers was extended by screening the reference lists of all selected studies by applying the inclusion criteria. The full-text versions of the selected papers were printed to perform assessment of psychometric properties.

2.3. Assessment of psychometric properties

The selected papers were assessed on psychometric properties by two observers independently. The assessment criteria (Terwee et al., 2007) are summarized in Appendix A. Criteria were rated as follows: '+' for being positively evaluated, '0' for being intermediately evaluated or '-' for being evaluated as 'poor' and '?' was assigned if no information on that criterion was found in the paper. Disagreements between the observers about the application of the criteria were first discussed, and if insolvable the third observer would be consulted for a final judgement. After assessing all the selected papers, a table was created in which an overview is presented of all ratings. If psychometric data on a questionnaire were presented in multiple papers, the ratings were cumulated in that table.

3. Results

3.1. Results of the search strategy

The database search revealed 165 abstracts. After initial selection, 19 abstracts met inclusion criteria. Involvement of the third observer was not needed. Four studies were additionally included in the review by cross checking the references, leading to a total of 23 studies including four questionnaires that were included in this

Table 1
Brief description of questionnaires and subscales aimed at measuring acceptance of chronic pain.

Questionnaire ^a	Relevant subscales	Description of construct	Number of items	Response categories	Range of scores
Chronic Pain Acceptance Questionnaire (CPAQ)	Original version: 1. Engagement in activities 2. Thoughts control pain 3. Pain may not change 4. Need to avoid/control Revised version: 1. Pain willingness 2. Engagement in activities	"Acceptance of pain"	34 in original form, 24 used for total score	0 ('never true') – 6 ('always true')	Original version: 0–144 Revised version: 0–120
Illness Cognitions Questionnaire (ICQ)	1. Acceptance	"Recognizing the need to adapt to a chronic illness"	6	1 ('not at all') – 4 ('completely')	6–24
Acceptance of Illness Scale (AIS), adapted to pain	1. Acceptance of pain	"The respondents' success in feeling 'acceptant' and valuable in spite of the problems and losses occasioned by the painful condition"	8	5 point scale	0–32
Pain Solutions Questionnaire (PASOL)	1. Acceptance of insolubility of pain subscale	"An approach to the problem of pain as an ability to disengage from problem-solving attempts and uncontrollability of their pain"	5	0 ('not at all applicable') – 6 ('highly applicable')	0–30

^a All questionnaires focus on patients with chronic pain, except the ICQ, which focuses on patients with chronic diseases.

systematic review. A brief description of the questionnaires, their subscales and constructs aimed to measure assessed is presented in Table 1. Upon comparison, it appears that each questionnaire aims to measure slightly different constructs.

The Chronic Pain Acceptance Questionnaire (CPAQ) aims at measuring acceptance of CP from a functional contextual point of view, focusing on behavioral aspects of acceptance of CP. Both the acceptance subscale of the Illness Cognitions Questionnaire (ICQ) (Evers et al., 2001) and the Acceptance of Illness Scale (Rankin and Holtum, 2003) reflect a cognitive-behavioral background, and are aimed at measuring how patients think, feel and believe they are accepting their CP. The Pain Solutions Questionnaire (De Vlieger et al., 2006) was created by combining items from three existing questionnaires: the ICQ, the CPAQ and the Tenacious Goal Pursuit and Flexible Goal Adjustment scale (Brandtstadter and Renner, 1990), reflecting an integrative approach aimed at measuring acceptance of CP.

The studies assessed and a summary of their psychometric properties and empirical findings are presented in Table 2.

3.2. Assessment of psychometric properties

The assessment of psychometric properties was performed by the two observers independently and a definite score was reached in consensus. Involvement of the third observer was not needed. The results of the ratings and explanations in case of intermediate or negative ratings are presented in Table 3.

3.2.1. Content validity

In one study evidence is presented that the target population was actively involved in item selection. In none of the other studies the target population was involved.

3.2.2. Internal consistency

In 14 studies new data on internal consistency were presented, in seven of these studies a component analysis was performed.

3.2.3. Criterion validity

None of the studies explicitly presented a gold standard of 'acceptance of CP'. Although in some studies the term "criterion validity" was used, technically they referred to other forms of validity, such as construct validity.

3.2.4. Construct validity

Twelve studies, in which construct validity was investigated, presented explicit hypotheses relating to the magnitude and direction of expected relationships with other questionnaires. Nine other studies presented information about construct validity without providing predefined explicit hypotheses. Three studies did not provide information on this subject.

3.2.5. Agreement

Two studies presented longitudinal data, in all other studies a cross-sectional design was used. None of the longitudinal studies presented data on Kappas or intraclass correlations (ICCs) of the questionnaires. Therefore, none of the studies we investigated provided information on agreement.

3.2.6. Reliability

One study presented data on ICCs or other preferable measures of reliability as defined in the assessment protocol.

3.2.7. Responsiveness

One of the investigated studies presented data on responsiveness. However, this study did not provide predefined and explicit hypotheses about expected effects.

3.2.8. Floor and ceiling effects

None of the investigated studies presented data on floor and ceiling effects.

3.2.9. Interpretability

In 1 study statistical data were presented on differences between relevant groups of patients. Because three subgroups were identified, which is less than four (criterion for a positive rating), this criterion was not rated positive for that study. None of the studies defined a meaningful clinically important difference (MCID).

In Table 3 an overview is presented of positive, poor, intermediate and missing ratings on all nine criteria mentioned above. Finally, in the last column of Table 3 the number of overall positive ratings is summarized. Out of nine psychometric quality criteria one questionnaire received no positive ratings (AIS), one questionnaire received one positive rating (PASOL), one questionnaire received two positive rating (ICQ), and one questionnaire received three positive ratings (CPAQ).

4. Discussion

Application of the psychological construct of acceptance of CP is a promising development in the field of rehabilitation of patients who suffer from CP. To facilitate research and clinical use, valid and reliable instruments to measure acceptance of CP are needed. The current study shows that when the criteria of Terwee et al. are applied for each study separately, none of the studies assessed presented satisfactory results for all properties. Most of the criteria assessed scored 'inconclusive', indicating absence of evidence as defined in the assessment criteria used in this study. Obviously, absence of evidence does not constitute evidence for absence of these properties. When combining the results of the selected studies, it may be concluded that data is available to support the hypothesis that acceptance of CP could be assessed by self-report questionnaires. More research is needed to provide data on criterion validity, agreement, reliability, responsiveness, floor/ceiling effects and interpretability. It is also recommended that in future development of acceptance of CP questionnaires more effort is spend on longitudinal and experimental studies among different cohorts and samples. Also, explicit predefined hypotheses based on a solid theory that provides an unambiguous definition of acceptance of CP should be used. Finally, in future research there should be an active involvement of the target population as well as professionals.

The clinical relevance of the findings of this systematic review is that clinical data gathered with any of the investigated questionnaires should be interpreted with caution, because it has not been demonstrated that 'acceptance of CP' can be measured validly within the limits of reasonable plausibility. However, if faced with the situation of having to choose an instrument aimed at measuring acceptance of CP for clinical practice or research, the preferred questionnaire based on psychometric properties should be the CPAQ. The CPAQ has received the highest rating, indicating more evidence to support the use of this questionnaire compared to the others. Additionally, the CPAQ appears to be the only questionnaire that is founded within a coherent theoretical framework of acceptance of CP (McCracken, 2005a,b). A well developed cognitive-behavioral theory on the role of acceptance of CP is lacking, therefore cognitive-behavioral based questionnaires aimed at measuring acceptance of CP, such as the ICQ or AIS, may be of limited scientific and clinical importance. Next to presented evidence on psychometric properties, but outside the scope of this study, there may be other reasons to choose one instrument over the other (for item content and purpose of the instrument).

Table 2
Description of selected studies, psychometric outcomes and relational results.

Questionnaire	Design	Study population#	Scale construction, scale analysis and internal consistency	Results presented to demonstrate construct validity*
<i>CPAQ</i>				
McCracken (1998)	CS	160 chronic pain patients referred for a pain management treatment	Cronbach's α without factor analysis: 0.84	Positive: education, work status, uptime ($0.21 < r < 0.46$) Negative: pain intensity, pain related anxiety, avoidance, depression, physical and psychosocial disability. ($-0.66 < r < -0.28$) N/A
McCracken (1999)	CS	230 chronic pain patients referred for a pain management treatment	one factor deleted after factor analysis. Cronbach's α on sum score: 0.84. Four remaining factors: 'Engaging in activities', 'Thoughts control pain', 'Pain may not change', 'Need to avoid/control' ($0.58 < \alpha < 0.90$) N/A	
McCracken et al. (1999)	CS	190 chronic pain patients referred for a pain management treatment		Negative: dysfunctional coping style Prediction of coping style in multivariate analyses and discriminative power with coping style in discriminant analysis ($r = -0.87$) Positive: mental health ($r = 0.45$) Negative: pain severity ($r = -0.12$), catastrophizing ($r = -0.42$) Unique prediction of mental well-being in regression analysis
Viane et al. (2003) study 1	CS	120 chronic pain patients referred for a pain management treatment	Cronbach's α of sum score without factor analysis: 0.78. Cronbach's α of subscales without factor analysis between 0.48 and 0.82. Significant correlations between subscales (absolute: $0.31 < r < 0.72$)	
Viane et al. (2003) study 2	CS	66 chronic pain patients referred for a pain management treatment	Cronbach's α of sum score without factor analysis: 0.82. Cronbach's α of subscales without factor analysis between 0.50 and 0.83. Significant correlations between subscales (absolute: $0.27 < r < 0.71$) N/A	Positive: acceptance (ICQ-acc subscale; $r = 0.39$), mental health ($r = 0.50$) Negative: helplessness, pain severity, catastrophizing ($-0.63 < r < -0.42$) Unique prediction of mental well-being in regression analysis.
McCracken and Eccleston (2003)	CS	230 chronic pain patients referred for a pain management treatment		Positive: uptime, work status, coping self-statements, ignoring pain ($0.30 < r < 0.38$) Negative: pain, physical disability, psychosocial disability, depression, pain related anxiety ($-0.70 < r < -0.32$). Hierarchical regression analyses revealed unique prediction of pain on outcome criteria > unique prediction of coping Positive: work status ($r = 0.33$) Negative: pain intensity, medical visits, pain medications, hours of daytime rest, physical disability, depression, pain related anxiety, psychosocial disability ($-0.60 < r < -0.19$) Hierarchical regression analyses reveals independent contribution of acceptance in prediction of all outcome criteria (see above)
McCracken et al. (2004)	CS	235 consecutive referrals for an inter disciplinary pain management program	Factor analyses and item analyses result in reduction from 34 to 28 items, Cronbach's α -s range from 0.62 (chronicity) to 0.82 (activity engagement), sum score $\alpha = 0.78$	Negative: social support, solicitous responses, punishing responses, distracting responses ($-0.32 < r < -0.15$) Hierarchical regression analyses reveals independent contribution of solicitous ($\beta = -0.22$) and punishing ($\beta = -0.33$) spouse responses in prediction of acceptance
McCracken (2005a,b)	CS	228 consecutive referrals for an inter disciplinary pain center	N/A	Negative: depression, pain related anxiety, physical disability, psychosocial disability, daily rest, pain medication ($-0.50 < r < -0.22$) Positive: uptime, work status ($0.23 < r < 0.38$). Unrelated: pain Hierarchical regression analyses reveals independent contribution of acceptance in prediction of all outcome criteria
McCracken and Eccleston (2005)	PROS	118 chronic pain patients referred for a pain management treatment	N/A	Positive: residualized change score of sit to stand frequency from pre- to post-treatment ($r = 0.40$) Negative: residualized change score of depression, pain related anxiety, physical disability, psychosocial disability ($-0.61 < r < -0.32$) Repeated measures ANOVA revealed significant increase in acceptance during acceptance-based treatment No total acceptance sum score presented
McCracken et al. (2005)	LT	108 consecutive referrals offered treatment on a pain management unit, 84 completed follow up	N/A	
McCracken and Eccleston (2006)	CS	230 consecutive patients seeking assessment from a pain management service	N/A	
Nicholas and Asghari (2006)	CS	252 consecutive patients referred for assessment and treatment of their persisting pain	Cronbach's α without factor analysis: 0.85. Factor analysis revealed four-factor solution	Positive: age ($r = 0.24$), pain self-efficacy ($r = 0.62$) Negative: pain intensity, physical disability, depression, fear of movement, catastrophizing ($-0.58 < r < -0.38$) No total acceptance sum score presented in hierarchical regression analyses

McCracken et al. (2007a)	CS	105 consecutive patients attending a clinical assessment for treatment of chronic pain	N/A	Positive: mindfulness ($r = 0.28$) Negative: pain intensity, pain-related distress, depression, interference due to depression, pain anxiety, physical disability, psychosocial disability, 'other' disability, alertness, number of pain medications ($-0.72 < r < -0.28$)
McCracken and Samuel (2007)	CS	276 individuals with chronic pain	N/A	Significant differences in acceptance of pain between four activity pattern clusters
Vowles et al. (2008a)	CS	344 consecutive patients seeking assessment from a pain management service	N/A	As in (McCracken et al., 2005) Acceptance of pain partially mediates the effects of catastrophizing across measures of depression, pain related fear, disability ($0.08 < r^2 < 0.55$)
Mason et al. (2008)	CS	86 CLBP outpatients	N/A	Positive: quality of life ($r = 0.38$ CPAQ; $r = 0.58$ SF-CPAQ).
Ning et al. (2008)	CS TRT	224 patients with chronic pain attending an outpatient multidisciplinary pain management program	Forward backward translation (Cantonese–English). Test–retest reliability 2 weeks ICC = 0.79. Cronbach $\alpha = 0.79$. factor analyses revealed same two-factor structure as original version.	Positive: pain self-efficacy ($r = 0.58$) and all subscales of SF36 ($r = 0.26$ tot $r = 0.46$) Negative: pain intensity ($r = -0.24$), anxiety ($r = -0.44$), depression ($r = -0.26$), pain catastrophizing ($r = -0.48$)
Vowles et al. (2008b)	CS	2 Samples ($n = 333$ and $n = 308$) of chronic pain sufferers presenting for assessment at a tertiary care center	CFA: support for 20-item, two-factor solution Cluster analysis revealed three subgroups: high AE and PW, high AE/low PW, low AE and PW	Subgroup low CPAQ reported higher depression, pain related anxiety, physical disability, psychosocial disability, and medical visits compared to high CPAQ. Subgroup discrepant CPAQ generally fell in between. Subgroup high AE reported lower daily activity and higher daily rest.
Wicksell et al. (2008)	CS	611 Swedish participants reporting chronic pain and symptoms of Whiplash Associated Disorder	Forward backward translation (Swedish–English) Item analysis excluded item 16 Exploratory and CFA confirmed two-factor solution. Cronbach's α total scale 0.91, AE 0.89, PW 0.83	Positive: life satisfaction ($r = 0.58$), quality of life ($r = 0.57$). Negative: pain ($r = -0.22$ to -0.34), work absence ($r = -0.28$), disability ($r = -0.58$), anxiety ($r = -0.54$), depression ($r = -0.66$), pain-related fear (-0.56). unrelated to age, education, use of prescribe pain medication. CPAQ explained more variance than TSK in pain intensity, disability, life satisfaction, depression
ICQ-acc subscale Evers et al. (2001)	LT	263 outpatients with rheumatoid arthritis (RA) and 167 patients with multiple sclerosis (MS)	Target population and professionals involved in item selection, factor analysis revealed three-factor solution one of which 'acceptance of illness' ($\alpha = 0.90$). Test–retest performed with one-year interval ($r = 0.77$).	Positive: positive mood, extraversion, optimism, active coping, passive coping, perceived support, social network ($0.14 < r < 0.59$) Negative: functional disability, physical complaints, negative mood, disease impact on daily life, neuroticism ($-0.54 < r < -0.16$)
Viane et al. (2003), study 2	CS	66 chronic pain patients referred for a pain management treatment	Cronbach's α of sum score without factor analysis: 0.94.	Positive: acceptance (CPAQ), disease benefits, physical health, mental health ($0.30 < r < 0.66$) Negative: pain severity ($r = -0.48$), catastrophizing ($r = -0.66$) Regression analysis revealed unique prediction of mental well-being by acc subscale.
Viane et al. (2004)	CS	Study 1: 501 chronic pain patients recruited from a self help group Study 2: 16 chronic pain patients recruited from a self help group for fibromyalgia, 46 chronic pain patients referred for a pain management treatment	Cronbach's α without factor analysis: 0.86.	Study 1 Positive: attention to pain ($r = -0.27$) Negative: pain severity ($r = -0.20$) Hierarchical regression analyses reveals independent contribution of acceptance in prediction of attention to pain ($\beta = -.025$, $\Delta r^2 = 0.06$) Study 2 Positive: activity efficacy, activity engagement, activity motivation ($0.29 < r < 0.32$) Negative: attention to pain ($r = -0.33$) Hierarchical regression analyses reveals independent contribution of acceptance in prediction of attention to pain ($\beta = -.027$, $\Delta r^2 = 0.07$).
AIS Rankin and Holttun (2003)	CS	116 participants attending an assessment for a pain management program	Cronbach's α without factor analysis: 0.78.	Negative: illness identity, consequences, number of symptoms ($-0.43 < r < -0.24$)
PASOL-ins De Vlieger et al. (2006)	CS	476 adults suffering from chronic pain	Factor analysis revealed a four-factor solution, one of which 'insolubility of pain'. Cronbach's $\alpha = 0.78$	Positive: age, meaningfulness of life despite pain, activity engagement ($0.18 < r < 0.59$) Negative: pain duration, pain severity, solving pain, attention to pain, catastrophizing, distress, disability ($-0.32 < r < -0.12$)

CPAQ = Chronic Pain Acceptance Questionnaire; SF-CPAQ = Short Form Chronic Pain Acceptance Questionnaire; AE = Activity Engagement; PW = Pain Willingness; ICQ - acc = Illness Cognition Questionnaire, acceptance subscale; AIS = Acceptance of Illness Scale; PASOL-insl = Pain Solutions Questionnaire, insolubility of pain subscale; CS = cross-sectional research design; TRT = Test–retest design; LT = longitudinal research design; N/A = not applicable; Positive = positive correlation with sum score; Negative = negative correlation with sum score ($p < 0.05$ or less); CFA = Confirmatory factor analysis; Δr^2 : change in proportion of total variance on dependent variable that is accounted for by the set of predictors. # all are English unless otherwise specified.

* Results are presented when significant ($p < 0.05$).

Table 3

Methodology rating and explanation in case of negative and intermediate ratings.

Questionnaire	Content validity	Internal consistency	Criterion validity	Construct validity	Reproducibility: agreement	Reproducibility: reliability	Responsiveness	Floor and ceiling effects	Interpretability	Total positive ratings
<i>CPAQ</i>										
McCracken (1998)	?	0 No factor analysis	?	+	?	?	?	?	?	
McCracken (1999)	?	+	?	?	?	?	?	?	?	
McCracken et al. (1999)	?	?	?	+	?	?	?	?	?	
Viane et al. (2003) study 1	?	0 No factor analysis	?	0 No explicit or predefined hypotheses	?	?	?	?	?	
Viane et al. (2003) study 2	?	0 No factor analysis	?	+	?	?	?	?	?	
McCracken and Eccleston (2003)	?	?	?	0 No explicit or predefined hypotheses	?	?	?	?	?	
McCracken et al. (2004)	?	+	?	0 No explicit or predefined hypotheses	?	?	?	?	?	
McCracken (2005a,b)	?	?	?	+	?	?	?	?	?	
McCracken et al. (2005)	?	?	?	0 No explicit or predefined hypotheses	?	?	0 No explicit or predefined hypotheses	?	?	
McCracken and Vowles (2008)	?	?	?	0	?	0	0	?	?	
McCracken and Eccleston (2006)	?	?	?	0 No explicit or predefined hypotheses	?	?	?	?	?	
Nicholas and Asghari (2006)	?	+	?	0 No explicit or predefined hypotheses	?	?	?	?	?	
McCracken et al. (2007a)	?	?	?	+	?	?	?	?	?	
McCracken and Samuel (2007)	?	?	?	+	?	?	?	?	?	
Vowles et al. (2008a)	?	?	?	+	?	?	?	?	?	
Mason et al. (2008)	?	?	?	+	?	?	?	?	?	
Ning et al. (2008)	?	+	?	0 No explicit or predefined hypotheses	?	+	?	?	?	
Vowles et al. (2008b)	?	–	–	0 No explicit or predefined hypotheses	?	?	?	?	0 < 4 subgroups	
Wicksell et al. (2008)	?	+	–	0 No explicit or predefined hypotheses	?	?	?	?		
CPAQ overall rating	–	+	?	+	?	+	0	?	?	3 out of 9
ICQ-acc										
Evers et al. (2001)	+	0 Too small <i>n</i> for factor analysis	?	+	?	?	?	?	?	
Viane et al. (2003), study 2	?	0 No factor analysis	?	0 No explicit or predefined hypotheses	?	?	?	?	?	
Viane et al. (2004)	?	0 No factor analysis	?	+	?	?	?	?	?	
ICQ-acc overall rating	+	0	?	+	?	?	?	?	?	2 out of 9
AIS										
Rankin and Holtum (2003)	?	0 No factor analysis	?	– Less than 75% of results in accordance with hypotheses	?	?	?	?	?	
AIS overall rating	?	?	?	–	?	?	?	?	?	0 out of 9
PASOL-ins										
De Vlieger et al. (2006)	– No population involvement	+	?	0 No explicit or predefined hypotheses	?	?	?	?	?	
Pasol-ins overall rating	–	+	?	?	?	?	?	?	?	1 out of 9

CPAQ = Chronic Pain Acceptance Questionnaire; ICQ-acc = Illness Cognition Questionnaire, acceptance subscale; AIS = Acceptance of Illness Scale; PASOL-insl = Pain Solutions Questionnaire, insolubility of pain subscale. Rating: + = positive, 0 = intermediate, – = negative, ? = no information available.

As demonstrated in Table 1, it appears that the questionnaires measure different aspects of the construct of acceptance, define the construct somewhat differently, or use different terms for the same construct (e.g. coping, embrace, control). Despite the differences, all instruments can be regarded to refer in different ways

to the same underlying construct or to tap different aspects of that underlying construct of acceptance. The instruments refer to different parameters or manifestations of acceptance. These parameters and manifestations of acceptance must be distinguished from psychological constructs that may be related to acceptance, such as

avoidance, cognitive fusion, psychological (in-) flexibility and mindfulness. That is, these constructs may be conceptualized as related to acceptance but they are not considered to be the same as acceptance. Moreover, while acceptance by definition is state specific (CP specific in this case), these psychological constructs are non-specific states or traits. Still, these related general constructs might be used for construct validation of measures of acceptance. For future scientific development and clinical use, it is recommended that a consented definition is developed. As an example of this, one may argue over the role of chronicity in the construct of acceptance. With regard to the construct validity of the CPAQ, it does not take acceptance of the chronicity of pain into account (acceptance of the fact that the pain will not decrease in the future and thus be part of life). When chronicity of CP is assumed an essential element of acceptance of CP, it should be part of the construct assessed. A questionnaire aimed at measuring acceptance of CP should thus reflect a willingness to engage one's pain, its chronicity and all its emotional and cognitive facets. Within contextual theory the finding that acceptance of *chronicity* of pain could not be measured validly by the CPAQ (McCracken et al., 2004) may be considered an important empirical finding, which should be subject of future research and underlines the need for a consented definition.

As can be observed in Table 2, the associations of acceptance of CP with other variables follow theoretically derived expectations. For example, acceptance of CP is positively related to adaptive coping behaviors (e.g. having an active coping style, staying physically and mentally active, work status) and outcome variables such as functional status, mental health and activity efficacy. Acceptance of CP is negatively related to nonadaptive behaviors, such as catastrophizing, taking daytime rest, taking more pain medication and avoidant reactions to pain, and negative outcomes of CP, such as physical and mental and psychosocial disabilities and disease impact on daily life. With regard to personality factors acceptance of CP is positively related to optimism and extraversion, and negatively related to neuroticism. In addition, acceptance of CP was found to be positively related to age, passive coping, ignoring pain, disease benefits, less pain severity, a smaller number of symptoms and shorter pain duration. These relations provide meaningful perspectives on acceptance. In conclusion, besides some unexplained relations, the majority of the correlations makes sense and fit theorizing about acceptance, its causes and its effects.

Four questionnaires or subscales of questionnaires developed to measure acceptance of CP were identified in this systematic review. The results of the assessment of psychometric properties as presented in this study should be interpreted in the light of a possible selection bias. These studies were retrieved by applying search terms in five databases with March 2009 as an end date. The studies were selected by the reviewers on predefined criteria. It may be possible that these search terms filtered out studies of potential interest or that after the end date new evidence became available. For instance, in this study the search term 'questionnaire OR assessment' was applied, which may result in other results when terms such as 'scale', 'method' or 'survey' was applied. Therefore the reference list of the papers identified in the data base searches were carefully inspected to find relevant papers not identified in the database searches. Also, the selection criterion which defined that only English, Dutch or German studies were to be selected may have influenced the number of selected studies. Finally, restriction to the five databases may have resulted in a bias of selection of relevant studies. Different methods of study retrieval and selection may result in different results and conclusions. However, based on an extrapolation of the results of the studies included, the chance that a missed or excluded study would significantly influence the overall conclusions of this review is deemed unlikely because the databases in which the literature searches were performed cover the majority of available scientific literature.

Additionally, the use of a different quality criteria protocol would also have led to different results and conclusions. The protocol used in this review may be considered overly strict and extensive, leading to 'negative' results or clear identifications of absence of evidence, and therefore harsh conclusions. For instance, predefined hypotheses about strength of expected relationships with other questionnaires may have been implicitly present in the mind of the authors but not described in the paper. Often, data were interpreted in the studies included, but they were rated negatively because the underlying hypotheses were not explicitly described. This may have led to a many negative ratings. Other studies have demonstrated that patients' scores on acceptance scales differ between pre- and post-treatment. However, because explicit criteria on how this change could be interpreted were absent, it was not rated positively in this review. However, we have chosen to use this set of criteria, because it is funded in the literature (Bot et al., 2004; de Boer et al., 2004; Terwee et al., 2006), and because alternative review protocols to systematically assess the psychometric properties of questionnaires are not available. By doing so the reproducibility of the review is fostered; the protocol used provides a transparent and broad quality rating of the instruments assessed. There are however some costs that come along with the choice: the criteria of Terwee et al. are in some cases arbitrarily chosen (for instance, the 75% criterion used in the assessment of construct validity and responsiveness, or the 15% criterion in floor and ceiling effects). We have presented the key results upon which our ratings were based in Table 2. Readers may use a different set of criteria or cut-off point and perform a separate rating. In the opinion of the authors these costs did not outweigh the advantages of using a standardized protocol. Finally, strict criteria will prevent a possible false positive quality assessment of the investigated instruments. On the other hand, strict criteria will also lead to an increase in false negative ratings. The authors of this review chose willingly to perform a systematic review instead of another form psychometric quality assessment, such as expert assessments, which would decrease the transparency of the study. An expert review may be more useful to perform qualitative research and to develop the theory of the construct of acceptance of CP.

During the reviewing process it became clear that issues were not addressed by the psychometric quality assessment protocol used. First, the current protocol does not take into account that psychometric data on one questionnaire may be spread among consecutive studies. For example, it is not unreasonable that once the target population is involved in the development of the questionnaire, consecutive studies will build on this and do not have to reproduce this aspect. Establishing construct validity tends to be a cumulative process that runs over years and data will be presented in more than one study. Therefore we plea for a comparability index in which is explicated on what grounds data of different studies can be merged in an overall analysis. Second, in the protocol the quality of the presentation of data receives no rating. Important information may be missed due to unclear presentation. We propose that presentation of data or *transparency* should be an added criterion in assessing methodological quality and should be rated as well. Some form of transparency has already been described by other researchers, for example by Wind et al. (2005), who propose that a positive rating on transparency ('analysis and presentation') is provided when "the presentation is unambiguous and presented tables and figures support the text". Another issue that was not addressed in this protocol was item-response rates.

5. Conclusion

If strict psychometric quality criteria are applied, none of the questionnaires are currently able to meet all nine criteria for psy-

chometric quality, but overlooking the cumulative results over all the studies conducted, especially for the CPAQ, it can be concluded that information on several important characteristics has been reported and a fairly clear picture emerges about the psychometric properties of the CPAQ.

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Appendix A

A.1. Criteria for assessment and rating of psychometric properties

A.1.1. Criterion 1: content validity

Content validity examines the extent to which the domain of interest is comprehensively sampled by the items in the questionnaire. A positive rating was given if the items were formulated after literature study, if a clear description of the measurement aim and target population was given and if experts and patients were consulted in the item creation phase. An intermediate rating was given if a clear description of these items was lacking or if only patients were consulted. A negative rating was given if there was no evidence of involvement of the target population or experts in the development of the content of the items.

A.1.2. Criterion 2: internal consistency

Internal consistency refers to the extent to which items in a (sub)scale were intercorrelated, thus measuring the same construct. A positive rating was given if internal consistency was established after a factor analysis had been performed among a sufficient number of subjects (seven times the number of items), and Cronbach's alphas were presented in the range between .70 and .95. An intermediate rating was given if Cronbach's alphas were presented without factor analyses or if for example a too small sample size was used in a factor analysis. A negative rating was given if Cronbach's alphas were presented below .70 or higher than .95 in spite of a good research design.

A.1.3. Criterion 3: criterion validity

Criterion validity is defined as the extent to which scores on a particular questionnaire relate to a "gold standard". A positive rating was given if convincing arguments were given that the criterion was a gold standard and the correlation between the questionnaire and the criterion was at least .70. An intermediate rating was given if a .70 or higher correlation was presented without convincing arguments. A negative rating was given if correlations with a gold standard were below .70.

A.1.4. Criterion 4: construct validity

Construct validity is defined as the extent to which scores on a particular questionnaire relate to other measures in a manner that is consistent with theoretically derived hypotheses concerning the concepts that are being measured. These hypotheses (or expectations) should be formulated explicitly and before statistical analyses. A positive rating was given if 75% or more of the results were in accordance of the predefined hypotheses, an intermediate rating was given if no explicit hypotheses were predefined. A negative rating was given if despite of good research design less than 75% of the results were in accordance of the hypotheses.

A.1.5. Criterion 5.1: reproducibility: agreement

Agreement, also called lack of *absolute measurement error*, refers to the precision of the questionnaire, which is expressed in the

units of the questionnaire. The rating of agreement depends on the difference between standard error of measurement (SEM) or smallest detectable change (SDC) on one hand and what is considered a minimal important difference (MID) in scores between or within persons on the other hand (Terwee et al., 2006). Agreement was rated positively if the SDC was smaller than the MID, or if convincing arguments were given that agreement is acceptable. An intermediate rating was given if no MID was defined and no arguments on agreement were presented. A negative rating was given if despite a good research design the MID equalled or turned out to be bigger than the SDC.

A.1.6. Criterion 5.2: reproducibility: reliability

Reliability is referred to as the extent to which the same results are obtained on repeated administrations of the same questionnaire if no change in significant other variables has occurred. To measure reliability the intraclass correlation coefficient (ICC), or kappa for dichotomous or ordinal data, is considered adequate. A positive rating was given if the ICC or kappa > 0.70, an intermediate rating was given if for example no time interval was mentioned or a less valid measure than a kappa was used. A negative rating was given if despite a good research design the ICC or kappa < 0.70.

A.1.7. Criterion 6: responsiveness

Responsiveness refers to the ability of the questionnaire to detect clinical important change over time in the measured construct, and should be considered the longitudinal aspect of the validity of the questionnaire. The rating of responsiveness is analogue to the rating of construct validity. A positive rating was given if predefined hypotheses about the longitudinal expected changes were presented and more than 75% of the empirical results were in accordance with the hypotheses. An intermediate rating was given if a doubtful design was used, for example if hypotheses were not explicitly described. A negative rating was given if despite a good research design less than 75% of the results were not in accordance with the predefined hypotheses.

A.1.8. Criterion 7: floor and ceiling effects

Floor and ceiling effects are defined as the percentage of respondents who score in the highest or lowest possible score of a questionnaire or subscale. A positive rating was given if less than 15% of the respondents achieved the highest or lowest score, a negative rating was given if more than 15% of the respondents achieved a highest or lowest possible score.

A.1.9. Criterion 8: interpretability

Interpretability is defined as the degree to which one can assign qualitative meaning to a quantitative (change in) scores. A positive rating was given if mean scores and standard deviations were presented for at least four relevant subgroups and if the minimal important change (MIC) was defined. An intermediate rating was given if a doubtful design was used, for example if data were provided on less than four subgroups or no MIC was defined.

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